## What is Claimed is:

[c1] A high performance SiGe HBT that has a SiGe layer with a peak Ge concentration of at least approximately 20% and a boron-doped base region formed therein having a thickness, wherein said base region includes diffusion-limiting impurities throughout said thickness at a concentration below that of boron in said base region, and wherein said diffusion limiting impurities are physically located relative to both said base region and a portion of said SiGe layer having a Ge concentration of 20% to optimize performance and yield of said SiGe HBT.

[c2] A high performance SiGe HBT that has a SiGe layer with a peak Ge concentration of at least approximately 20%, a boron-doped base region formed therein having a thickness, and a region of diffusion-limiting impurities at a concentration, thickness, and spacing relative to said base region and a portion of said SiGe layer having said peak concentration of Ge that optimizes both performance and yield of said SiGe HBT.

[c3] A method of producing a SiGe layer on a Si substrate, comprising the steps of :
introducing germanium atoms during formation of a Si layer, such that at least a portion of said SiGe layer has a peak Ge concentration of at least 20%;
introducing diffusion-limiting impurities and boron atoms during formation of said Si layer, while said germanium atoms are still being introduced; and
terminating both said diffusion-limiting impurities and said boron atoms approximately simultaneously, said diffusion limiting impurities being introduced at a concentration and for a duration that optimizes both performance and yield.

[c4] The device of claim 1, wherein said SiGe layer is of a thickness of approximately 300-900 A.

[c5] The device of claim 1, wherein the Ge has a peak concentration thickness of approximately 20-100 angstroms.

[c6] The device of claim 5, wherein said base region is approximately 10-150 angstroms in thickness.

[c7] The device of claim 6, wherein the base region has a peak boron concentration of boron of approximately 8.5 x 10 E 19 / $cm^3$ .

[c8] The device of claim 1, wherein said diffusion limiting impurity comprises carbon.

[c9] The device of claim 8, wherein said carbon has a peak concentration between approximately 1 x 10 e 19 / cm $^3$ and 4 x 10 e 19 / cm $^3$.

[c10] The device of claim 8, wherein said carbon defines a dopant region that is approximately 10 - 500 angstroms in thickness.

[c11] The device of claim 8, wherein said carbon has defines a dopant region having an upper bound and a lower bound, wherein said peak concentration thickness of said Ge has an upper bound and a lower bound, and wherein said lower bound of said carbon region is within approximately 150 angstroms of said upper bound of said peak concentration thickness of said Ge.

[c12] The device of claim 10, wherein said base region is within approximately 200 - 250 angstroms of said upper bound of said peak concentration thickness of said Ge.

[c13] The method of claim 3, wherein said diffusion-limiting impurities comprise carbon, and wherein said carbon is first introduced when said Ge reaches a plateau concentration.

[c14] The method of claim 11, wherein said diffusion-limiting impurities come from a gaseous source.

[c15] The method of claim 12, wherein said gaseous source comprises ethylene.

[c16] The method of claim 13, wherein when said germanium atoms are introduced at a peak flow rate of Germane at 28 SCCM, said ethylene is provided at a rate of 40 SCCM.

[c17] A SiGe HBT comprising an SiGe layer, a base region, and a diffusion-limiting region, in which said diffusion-limiting region extends substantially throughout said base region and has a dopant concentration less than that of said base region, and wherein both said base region and said diffusion-limiting region are spaced within a given distance of a portion of said SiGe layer having a Ge concentration of at least approximately 20% so as to optimize both performance and yield of said SiGe HBT.

[c18] The device of claim 16, wherein said base region is within approximately 250 A of said portion of said SiGe layer having a peak Ge concentration.

[c19] The device of claim 17, wherein said diffusion-limiting region is within approximately 150A of said portion of said SiGe layer having a peak Ge concentration.

[c20] The device of claim 17, wherein said base region is within approximately 250 A of said portion of said SiGe layer having a peak Ge concentration, and wherein said diffusion-limiting region is within approximately 150A of said portion of said SiGe layer having a peak Ge concentration.